WHAT IS CLAIMED IS:

1. A semiconduct r substrate comprising:

a front face and a rear face that are both mirror-polished,

wherein said semiconductor substrate meets an SFQR value $\leq$ 70 (nm) as a flatness of the front face, and contains boron at a concentration higher than or equal to 5×10^{16} (atoms/cm^3) lower than or equal to 2×10^{17} (atoms/cm^3).

2. The semiconductor substrate according to claim 1, wherein a crystal layer is provided on the front face.

3. The semiconductor substrate according to claim 2, wherein a minimum value of the concentration of boron [B] (atoms/cm^3) is defined for a required thickness t (μm) of the crystal layer, based on a relational equation

$$[B] \geqq (2.2 \pm 0.2) \times 10^{16} \exp(0.21t).$$

4. The semiconductor substrate according to claim 2, wherein a maximum value of a thickness t (μm) of the crystal layer is defined for a required concentration of boron [B] (atoms/cm^3), based on a relational equation

$$[B] \geqq (2.2 \pm 0.2) \times 10^{16} \exp(0.21t).$$

5. The semiconductor substrate according to claim 2, wherein the crystal layer is a silicon crystal layer formed by epitaxial growth.

6. The semiconductor substrate according to claim 2, wherein the crystal layer is a silicon-germanium alloy crystal layer.

7. The semiconductor substrate according to claim 2, wherein the crystal layer is a layer in a layered structure of a silicon-germanium alloy crystal layer and a silicon crystal layer.

8. The semiconductor substrate according to claim 7, wherein the silicon crystal layer is formed in an SOI structure in which the silicon crystal layer is separated by a silicon oxide layer.

9. The semiconductor substrate according to claim 2,

wherein said semiconductor substrate is an SOI substrate; and

wherein the crystal layer is an upper silicon crystal layer separated by a silicon oxide layer.

10. The semiconductor substrate according to claim 9, wherein the SOI substrate is formed by a SIMOX method.

11. The semiconductor substrate according to claim 9, wherein the SOI substrate is formed by a bonding method.

12. The semiconductor substrate according to claim 1, wherein the rear face is in an exposed state, or a natural oxide film having a thickness of 1 (nm) or less is formed on the rear face.

13. The semiconductor substrate according to claim 1, wherein carbon is contained at a concentration f 1 × 10^{15} ($atoms/cm^3$) or higher.

14. A semiconductor device, comprising:

a semiconductor substrate having a front face and a rear face that are both mirror-polished, said semiconductor substrate meeting an SFQR value ≦ 70 (nm) as a flatness of the front face, and containing boron at a concentration higher than or equal to 5 × 10^{16} ($atoms/cm^3$) lower than or equal to 2 × 10^{17} ($atoms/cm^3$); and

a semiconductor element formed on the front face of said semiconductor substrate.

15. A manufacturing method of a semiconductor substrate, comprising the steps of:

forming a silicon wafer by doping with boron at a concentration higher than or equal to 5 × 10^{16} ($atoms/cm^3$) lower than or equal to 2 × 10^{17} ($atoms/cm^3$);

mirror-polishing a rear face of a front face of the silicon wafer, the front face being a face on which a crystal layer is to be formed;

mirror-polishing the front face of the silicon wafer to achieve an SFQR value of the silicon wafer ≦ 70 (nm); and

forming a crystal layer on the front face of the silicon wafer.

16. The manufacturing m thod of a semiconductor substrate according to claim 15, wherein th crystal layer is a silicon-g rmanium alloy crystal layer.

17. A manufacturing method of a semiconductor substrate, comprising the steps of:

forming a silicon wafer by doping with boron;

mirror-polishing both faces of the silicon wafer; and

forming a crystal layer on one of the faces of the silicon wafer,

wherein an SFQR value $\leqq$ 70 (nm) is met, and a concentration of boron is made higher than or equal to 5×10^{16} (atoms/cm^3) lower than or equal to 2×10^{17} (atoms/cm^3), by the mirror-polishing of both faces of the silicon wafer.

18. The manufacturing method of a semiconductor substrate according to claim 17, wherein the crystal layer is a silicon-germanium alloy crystal layer.